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GUIDELINES FOR TYPE DESIGNS FOR CHECK BARRIERS

(First Revision)

THE INDIAN ROADS CONGRESS

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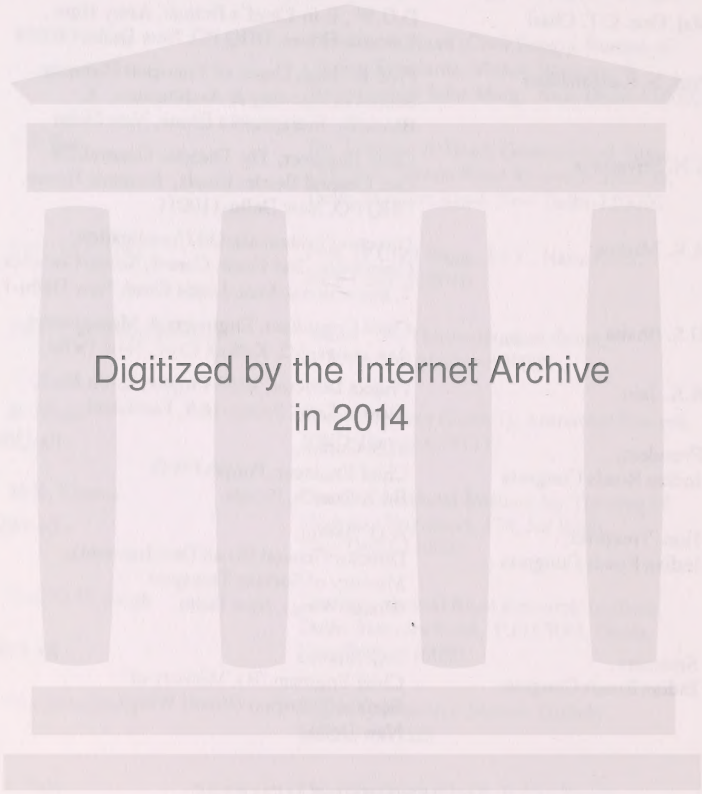

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GUIDELINES FOR TYPE DESIGNS FOR CHECK BARRIERS

1. INTRODUCTION

1.1. The need for the revision of the existing IRC Standard on "Type Designs for Check Barriers" was felt by the Traffic Engineering Committee (TEC) in 1987. Therefore, in its meeting held on 12th June, 1987 a Sub-Committee comprising Shri R.P. Sikka, Chief Engineer (Traffic & Transportation), MOST, Shri J.B. Mathur, Dy. Secretary, IRC and Shri D. Sanyal (NATPAC), Member-Secretary of Traffic Engineering Committee, was formed to revise the scope of the standard so as to include design aspects, drainage and other facilities for the checking authorities as well for the drivers of the vehicles. The revised draft prepared by Shri Sanyal was discussed in TEC meeting held on 23rd August, 1991. A Sub-Group consisting of S/Shri M.K. Bhalla, Member-Secretary, TEC, V.K. Arora, Chief Engineer, MOST and D. Sanyal was constituted to review the draft and revise it in the light of the comments offered by the members in the said meeting. The draft prepared by this Sub-Group was again discussed in the Traffic Engineering Committee in its meeting on 31st August, 1992 when some additional comments were given by the members. The draft was again discussed during the meeting of Traffic Engineering Committee held on 18th October, 1993 when members felt that it required further modification in the light of the discussions. A Sub-Group was again constituted comprising of S/Shri D. Sanyal, T.S. Reddy, Maxwell Pereira, A.P. Bahadur and Dr. Vishwanath to finalise the document. The document was finally discussed by TEC (personnel given below) in its meeting held on 31st August, 1995 and approved.

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1.2 The Highways Specifications & Standards Committee discussed the draft in its meeting held on 19th March, 1996 and approved the draft for being sent to the Council after the comments received from the members were duly incorporated. The guidelines were approved by the Executive Committee in its meeting held 17th April, 1996 and the Council in their meeting held at Darjeeling on 24th May, 1996.

1.3. It has been noticed that highway check barriers in use at present are often crude improvisations, and are unsatisfactory from the point of view of both safety and free flow of traffic. Moreover, they have usually no proper lighting arrangements and warning devices like signs, at their approaches which causes further hazard.

1.4. The Indian Roads Congress as a body is totally against the erection of any barriers on roads since these act as an impediment to the smooth flow of vehicles, thereby destroying the function of the highway, besides being a source of accidents. But in the interest of road users it has been felt that the designs of barriers might be made as less objectionable as possible. Towards this end, the Highways Specifications and Standards Committee has evolved the type designs given herein for general adoption.

1.5. The publication of these Guidelines should, however, in no way be taken to mean that the basic policy of the Indian Roads Congress in regard to highway barriers has undergone a change. These designs should be made use of only when it becomes unavoidable to have a barrier.

2. SCOPE

This document deals with guidelines for type designs of highway check barriers excluding toll tax collection barriers for which the Ministry of Surface Transport has issued separate guidelines. Type design for check barriers in urban location has also been briefly covered.

3. TYPE DESIGN OF CHECK BARRIER

3.1. There are different types of check barriers in use for different purposes and at different locations. The more important types of check barriers in use are as follows:

(i) **Highway check barriers**

Such check barriers are usually erected for the purpose of collection of sales tax, octroi tax, commercial tax and entry tax. These are also at times used for the purpose of checking by forest and road transport authorities;

(ii) **Toll barriers**

This is a special type of barrier that is specifically used for the purpose of collection of toll;

(iii) **Check barriers in urban areas**

Check barriers in urban areas are usually erected for security purpose by local police authorities.

3.2. Design of check barrier is a highly case-specific exercise and each design has to take into account various local considerations including traffic requirements and physical constraints peculiar to any specific site. However, certain degree of uniformity and consistency in design must be maintained for the purpose of ensuring the desired levels of safety, efficiency and economy of traffic operation through such areas. With a view to provide uniformity and consistency, three type designs, applicable to the most commonly occurring situations, are given below:

(i) **Highway check barriers with lay-byes on one side - Plate I**

This is applicable to all roads where checking is required for vehicles on one lane only i.e. while entering or exiting a jurisdiction of an authority.

(ii) **Highway check barriers with lay-byes on both sides -Plate II**

This is the most common type of design required at all inter-state border locations and on entry into major towns or cities. This is required where checking of commercial traffic is required in both directions for purposes of tax collection etc.

(iii) **Check barriers in urban areas - Plate III**

A brief description of check barriers in urban areas is placed in ***Annexure-1.***

3.3. The choice of a design shall be based on a consideration of conditions existing at site including the volumes of traffic requiring checking and being allowed free passage. These designs may be modified, with the approval of the Highway Authority, to suit local site conditions.

4. DESIGNS

4.1. Location

The barrier shall be so located as to be visible from a sufficient distance ahead when approached from either direction. This distance shall at- least be equal to the stopping sight distance corresponding to the design speed of the highway on which the barrier is set up. For sight distance values, reference may be made to IRC: 66-1976 "Recommended Practice for Sight Distance on Rural Highways".

4.2. Surveys

4.2.1. The design of barrier depends largely on the purpose for which it is to be put up, the length of time it is likely to remain in operation, traffic volumes, permissible delays and queue lengths. The studies to be carried out for design of check barriers are as follows:

(i) Traffic volume survey, parking surveys (in case vehicles are being made to halt);

(ii) Road and space inventory surveys;

(iii) Requirements of the concerned authorities at the proposed site of the barrier.

4.2.2. Traffic volume surveys

Seven days continuous, categorywise, traffic volume counts, preferably during peak season, are to be taken at the location (or within its influence area) where a check barrier is proposed to be erected. If due to some local constraints, it is not possible to carry out the seven days count, at least three days continuous traffic volume count must be done. This data is to be analysed for finding out the average number of commercial and other vehicles that may have to be handled at the barrier. Depending on past trends or, on the basis of any other study carried out, this data shall be projected for the design period of 15 years (after commissioning of facility) for estimating the design volume for which lay-byes are to be provided. Such a traffic volume survey will also help to ascertain the actual number of lanes that would be required to be provided at and near such a barrier. Care must be taken to account for seasonal fluctuation in traffic wherever such trends are known to exist such traffic volume surveys, as mentioned here, are also recommended at locations where redesign of an existing check barrier becomes necessary.

4.2.3. Parking and accumulation survey

4.2.3.1. At locations where check barriers already exist, both parking accumulation and parking duration surveys need to be carried out. In case of queuing at such locations, maximum queue lengths are also to be recorded. The time required for servicing the queue through the check barrier must also be studied in this context. Parking survey should be carried out continuously for a period of three days. Data, so collected, shall be projected for the design period for estimating the parking duration and parking usage. Parking survey is to be carried separately for each approach direction.

4.2.3.2. At locations where no check barrier exists, (i.e. while designing a new facility), the parking demand should be on the basis of expected delays as may have been observed under similar conditions elsewhere and the average existing parking demand if any, within the influence area of the chosen location. Continuous survey for 24 hours on a sample day may be adequate for this purpose under ordinary circumstances. However, if peaking is known to occur on any particular day of the week, survey should be carried out on such days. Parking data collected like this is to be used in conjunction with the design parking demand that may be estimated from the number of vehicles that would be serviced at the proposed location after erection of the check barrier. A sample calculation in this regard is placed at ***Annexure-2.***

4.2.4. Road and space inventory survey

Whether it is for redesign of an existing check barrier or design of a new one, road and space inventory surveys are essential and must be carried out with utmost care and precision. Accurate physical survey plans for the road stretch upto 500m on either side of the designated check barrier location must be prepared to a scale of 1:500. The survey must cover a strip of 100m on either side of the center line of the road for the entire designated check barrier stretch. All physical features including road land boundary, control lines, details of road side developments and properties and cross roads if any, drainage pattern of the area etc., must be correctly depicted in the plan so prepared. Well grown trees and their exact locations must also be marked on the plan.

4.3. Geometric Design

4.3.1. Carriageway width

The maximum width of carriageway for through traffic movement of traffic must not be less than the formation width of the approach road for a two lane highway. Thus for a two lane highway with 7.0m of approach carriageway width, the through carriageway at the check barrier must be 12.0m wide while, in the case of four lane divided section of approach carriageway, the minimum width of through carriageway at the lay-by must not be less than 8.5m in each direction.

4.3.2. Lay-by

4.3.2.1. **Length** : The length of the lay-by (s) should be adequate to cater to peak parking demand estimated on volume projections and average delays expected.

4.3.2.2. **Width** : Each lay-by must be two lane wide (7.5m) so as to enable parking of one vehicle on the left side and another vehicle to pass the parked vehicles along the adjacent lane. Islands separating the lay-bys within the parking area should have adequate width and in any case, not less than 1.5m for accommodating various service lines, electric poles etc.

4.3.2.3. **Entry/exit** : Entry to and exit from lay-by(s) shall be designed with a taper of not less than 1 in 15 and no entry/exit curve (turning) shall be less than 18.0m in radius. For multi axle vehicles, the turning-radius may be increased.

All edges and corners within this area must be suitably rounded off.

4.3.2.4. **Segregation of lay-by from main carriageway :** Segregation of the lay-by from the main carriageway is to be achieved through the provision of a barrier island with a minimum width of 3.0m. This island must have suitable guard rails. No bus bays are to be provided within the influence area of the check barrier.

4.4. Barrier Gate

Wherever possible, the electrically operated barrier gate may be provided at the exist lane of the check barrier as per the details mentioned in ***Annexure-3.*** Details of manually operated barriers are shown in Fig. 1.

4.5. Vertical Clearance

The vertical clearance below the barrier on the main carriageway shall be such as to allow movements of light motor vehicles, government vehicles and military vehicles without any interruption. Under normal circumstances traffic on the main carriageway will not be required to stop at the barrier. The vertical clearance below the barrier on the main carriageway shall not be less than 2.5m and such barrier will be designated as high barriers.

The barriers across the lay-by must have a more effective control on the passage of vehicles through these lanes and as such, the vertical clearance below the barriers across the lay-by shall be 1.5m. Such barriers will be designated as low barriers.

4.6. Pavement Design for Lay-by

The pavement for the through carriageway must be designed as per IRC:37-1984. The pavement for lay-bys should be designed keeping in view the local soil characteristics and the expected loading patterns in the proposed lay-bys. Reference may be made to IRC:37-1984 for this purpose.

4.7. Drainage of the Area

The entire area occupied by the lay-bys must have adequate drainage facilities. The agency maintaining the check barrier area must ensure regular and effective cleaning of gully pits and drainage channels. Usually the area must have

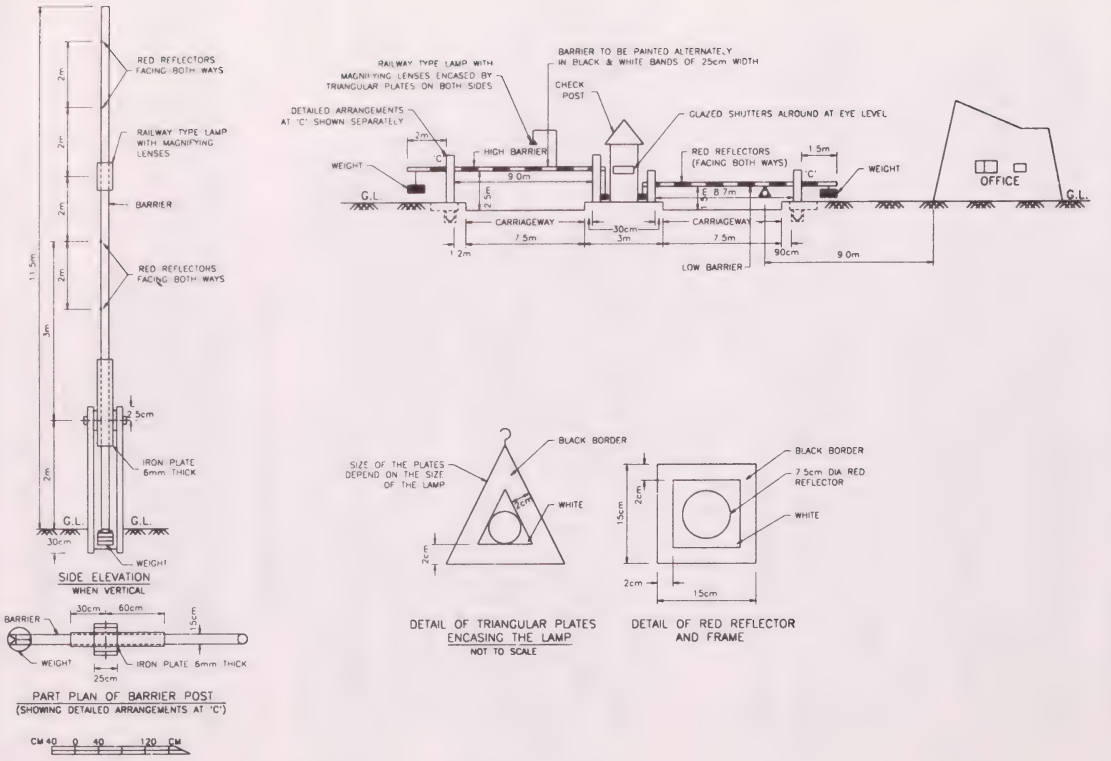

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Fig.1. Details of manually operated barrier

a longitudinal slope of not less than 0.5%. The parking bays within the area must also have a transverse slope of 2%. Gully pits should normally be located with silt trap at a distance of 30m c/c. The paved parking area will have underground transverse drains made up of precast concrete pipes. The gully pits should be suitably connected to such transverse drains that would ultimately discharge onto the main drain running along the highway. The diameter of the pipe drains will have to be determined on the basis of design discharge and, in no case, should be less than 300mm. At places where the drainage will have to be linked with a nearby culvert, the corresponding levels will have to be designed keeping in view the invert level of the drainage channel at the culvert. While deciding the direction of slopes etc., the general topography of the area must be kept in view. Adequate drainage from toilets to sewers and soakpits should be provided.

5. SIGNS, MARKING AND LIGHTING

5.1. Signs

The entire area around the lay-bys must have adequate signages so as to guide the drivers efficiently through the area. Being essentially an eccentric design, adequate care must be taken to evolve the signage and marking scheme in a scientific and case specific manner. Retroreflective sheeting shall preferably be used.

Some of the more important signs to be put up at any highway check barriers are as follows:

5.1.1. Warning signs

The signs "Slow - Barrier Ahead" (Fig. 2) and "Dead Slow - Barrier Ahead" (Fig. 3) should be placed at 200m and 120m respectively in advance of the high barrier location.

5.1.2. Mandatory signs

Mandatory signs such as "Compulsory left turns for HTVs and MCVs" etc., must be provided 60m in advance of the high barrier location. Preferably, gantry mounted signs should be provided for better visibility.

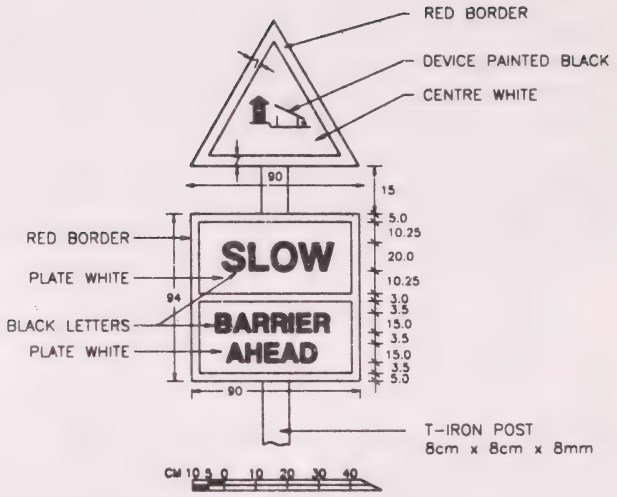


Fig. 2 Warning Sign for "Slow - Barrier Ahead"

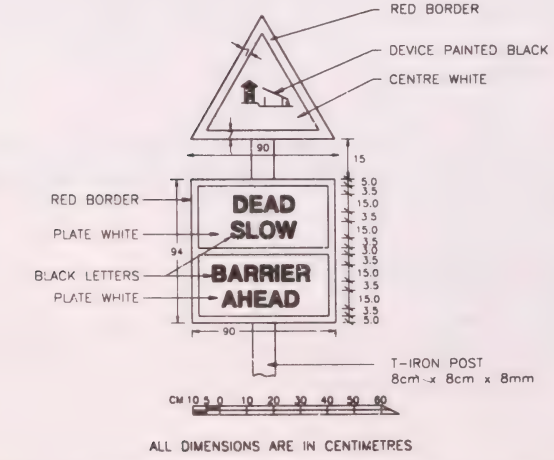


Fig. 3 Warning Sign for "Dead Slow - Barrier Ahead"

5.1.3. Informatory signs

Informatory signs indicating various facilities/amenities available must be provided at appropriate places.

5.2. Marking

The carriageways and the lay-bys, including the approach areas must have proper pavement markings for traffic guidance as per IRC:35 (under revision). As far as possible thermoplastic paints must be used for pavement marking purposes. In order to further accentuate the lay-bys, suitable delineators should be installed at the entry/exit areas to/from the lay-by.

5.3. Lighting

The entire area, including the parking areas, must be properly illuminated. Road side/median lighting may be provided with the help of sodium vapur lamps allowing a 6m clearance over the carriageway. Lamp posts may be located at 30m c/c. Provision of adequate high mast lighting may be considered for parking areas.

6. OFFICES, WEIGH BRIDGES AND OTHER FACILITIES

6.1. Offices

Checking offices will essentially be sturdy structures with a covered area as per the requirements of the concerned agencies/govt. deptts. The checking office must have adequate visual transparency. These should be properly equipped with toilet, drinking water facilities, etc. Provision may also be made for Police Booths if required. These offices must be conveniently located with adequate space for the drivers to queue up under shade. The entire area around these offices must be adequately lighted. Part of the office structure should project into either lay-bys or the carriageway.

6.2. Weigh Bridges

Generally, each separate service channel must be provided with a flush type weigh bridge for checking the laden weights of commercial vehicles. In order to facilitate the entire process of checking, such weigh bridges must be located before entry to the idle parking area. The weighing bay must have certain office space for the inspector.

6.3. Wayside Amenities

Wayside amenities would generally include eating places, drinking water points, toilets and washing areas, public telephone, first aid facilities etc. Filling stations, auto repair shops, spare parts shops etc., must be located at least 500m away from the lay-by area. No such development should be encouraged along the opposite flank of the road within the influence area of the check barrier. If there are other built up properties along the road over this section, efforts must be made to serve such properties with the help of service roads.

6.4. Landscaping

Beautification of check barrier areas should be done on a scientific basis through proper landscaping/plantation etc. Landscaping must be done in such a manner that it could discourage encroachments. Low height plants/shrubs should be planted on medians/islands, separating the lay-bys.

7. SAFETY MEASURES

7.1. The barrier shall be painted in alternate black and white bands of 25cm width so as to improve its visibility.

7.2. For safety of night traffic, a railway type lamp and red reflector shall be fitted to the barrier.

7.3. In urban areas, flickering electric lights should be provided on approaches to the barriers if considered necessary by the traffic authority.

7.4. All the safety devices mentioned above must be kept well maintained and functioning properly. This applies especially to pavement markings and the lamps for night traffic.

8. ROAD SIDE DEVELOPMENT CONTROLS

No uncontrolled road side development must be permitted within the influence area of the check barrier. Barring wayside amenities essential for waiting drivers and cleaners, no other uses must be permitted adjacent to the lay-bys.

Annexure-1

CHECK BARRIERS IN URBAN AREAS

1. Check barriers on urban roads are usually put up for security reasons generally by the concerned police departments. The objective behind erection of such barriers is to slow down the traffic and bring such vehicles to a halt as are considered necessary by the police personnel.

2. Check barriers along busy urban streets are obviously an impedement to smooth flow of traffic and the erection of the same must, therefore, be decided very judiciously. Such barriers must not be left unattended at any time of day or night.

3. Visibility along urban streets is of paramount importance and as such, the barriers used in urban areas must ensure adequate visibility across the baffles.

4. Since all vehicles are usually not required to be stopped or checked, the barriers in urban areas are required to have segmental construction and layout as shown in Plate III.

5. Usually mobile barriers are made use of in urban areas as these may be required to be moved to different points depending on the exigency of the situation. A typical design of such a check barrier is shown in Plate III.

6. Extreme caution must be exercised towards placing of such barriers along urban streets. These must be placed only on straight sections of roads having adequate widths and clear visibility. These must not be placed close to an intersection or a side road. When placed across an undivided carriageway, care must be taken to ensure that sufficient space is available for simultaneous movement of two opposing files of vehicles through barrier location. For better visibility at night such barriers must be painted in yellow and must be placed at a well lit portion of the road. Additional visibility and safety must be

ensured, if necessary, through the use of flickering lights mounted on the barrier frame.

7. A rest room for security personnel must be provided at locations where such barriers are erected on a permanent basis.

8. Under no circumstances the barriers should obstruct the movements of pedestrians along the footpaths.

Annexure 2

USER GUIDELINES FOR PLANNING OF PARKING BAYS AT CHECK BARRIERS

It is proposed to set up a check barrier along a National Highway having surveyed A.D.T. of 5000 vehicles. The various design parameters could then, be calculated as follows:

Given Average Daily Traffic Volume	- 5000 vehicles
Volume of commercial vehicles (as may be assumed or as may be revealed by actual field surveys)	- 40% of ADT (say)
Total number of commercial vehicles	- 2000 v.p.d.
Directional split	- 60:40 (say)
Volume of commercial traffic in predominant direction	- 2000x0.6 v.p.d. - 1200 v.p.d.
Peak hour peak direction component	- 10%
Peak hour arrivals	- 1200x0.10 v.p.h. - 120 v.p.h.
Average time required for checking (assumed or verified from another check barrier)	- 5 minutes (say)
Handling capacity of a single channel service checking window facility	- 12 v.p.h.

If an effort is to be made to match the service rate with the rate of arrivals, this particular complex would require 10 service channels (checking windows). In case it is not possible to provide adequate number of service channels (10 in the present example) number of windows could be reduced depending on site constraints with suitable increase in the lengths of the lay-bys. However, the service rate, under such circumstances, being less than the rate of arrival, one could expect building up of queues for which separate holding areas of adequate capacity must be planned. For example, if only 4 service windows can be provided at the site, instead of 10 service windows as described above, the number of commercial vehicles, that could be serviced in 1 hour work out to (60/5 x 4)48. Therefore the idle parking requirement would be (120-48)-72 vehicles during the peak hours. However the total requirement of the idle parking lot must be assessed on the basis of the availability of land and other local considerations.

Annexure-3

ELECTRICALLY OPERATED BARRIER GATE

Electrically operated barrier gates shall be provided at exit lane of the check barrier. The gate unit shall have the following salient features.

(i) Remote push-button control from the toll booth;

(ii) Quick operation - 5 seconds for lifting/lowering (90 degrees) for booms upto 4.5m length and 8-10 seconds for booms in wider lanes. However the effective time of opening will be less and the vehicles will be able to pass when the gate opens to an angle of about 75 to 80 degrees;

(iii) Automatic stop in fully raised/lowered position and automatic locking of the boom wherever it stops;

(iv) Alternate stripes of black and yellow or red and white on the boom for high visibility. Bands of reflective tape for night warning would be required;

(v) The driving unit shall be totally sealed for external use;

(vi) Manual operation of the gate shall be possible in case of power failure or break down.

A general arrangement of the barrier gate is shown in Fig.4.

A separate switch shall also be provided, operation of which shall cut out the automatic control and enable the operator to control opening, closing and mid stopping of the barrier by means of the 3 push buttons provided in a small barrier control box besides the cash register. This direct operator control may be used by him in case a continuous stream of vehicles are passing, and he feels that there is no need to open and close the barrier for each vehicle. This override switch may also be required in case of any failure of the vehicle sensor unit.

The electrically operated barrier shall have a system for disengaging the electrical drive system from the boom and counter-weights, so that the barrier can be operated by hand just as if it was a manually operated barrier. This facility can be used in case of power failure for operation of the barrier or during breakdown.

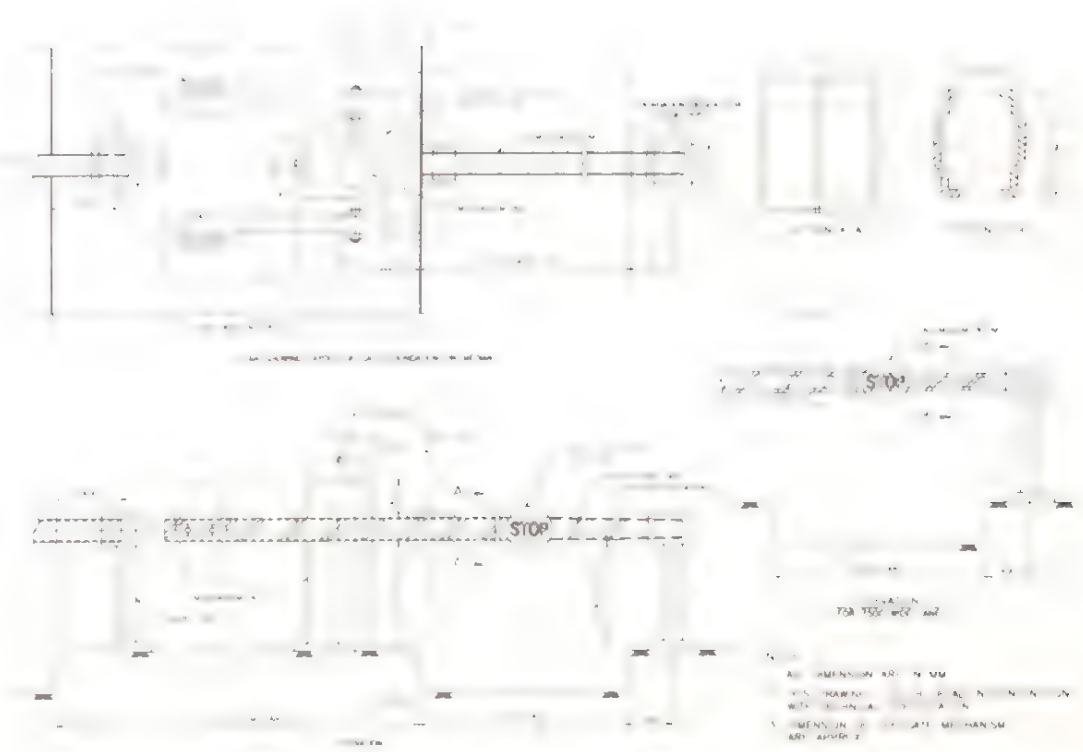
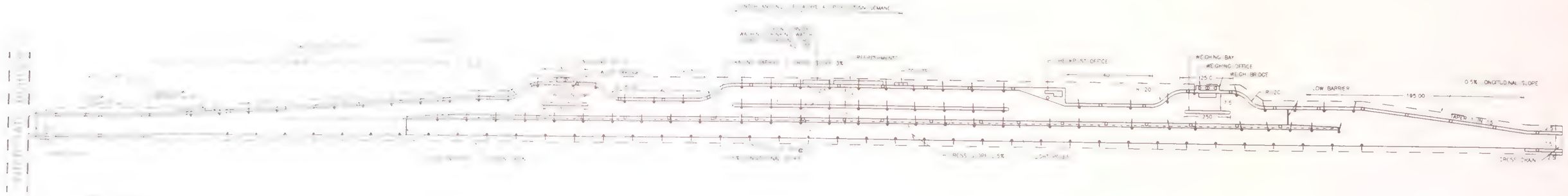


Fig 4 General Arrangement Drawing for Electrically Operated Barrier Gate

PLATE – I



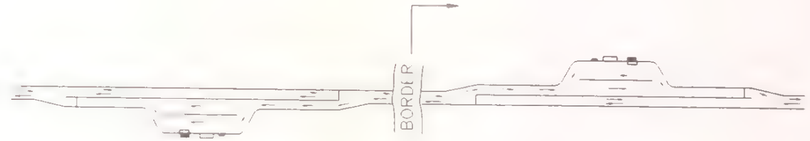
ARE INDICATIVE OF A TYPICAL CASE AND SHOULD GENERALLY BE TREATED AS DESIRABLE MINIMUM (UNLESS OTHERWISE SPECIFIED)

DIFFERENT COMPONENTS OF DESIGN SUCH AS MEDIAN OPENINGS, SERVICE ROADS, TURN ROUND AREAS, AND EVEN R.O.W. OF THE ROAD WILL HAVE TO BE TPEATED IN A CASE-SPECIFIC MANNER

LIGHTING

LEGEND

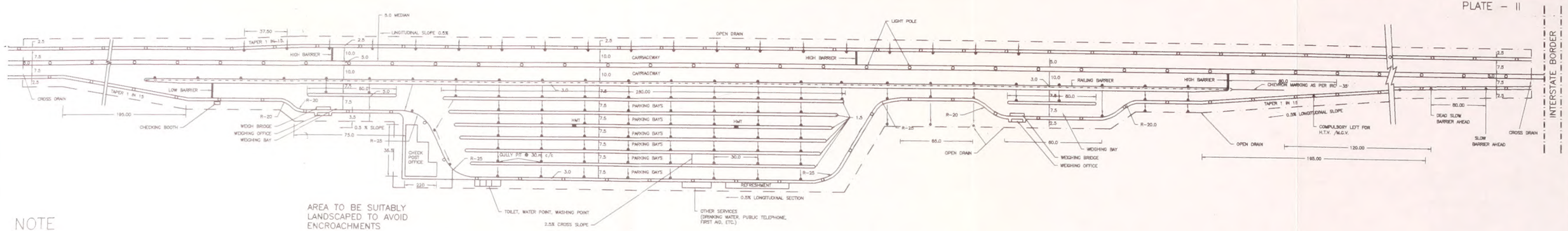
- DRAINAGE SYSTEM
- PEDESTRIAN RAILING
- LIGHT POLES
- ROAD SIGNS
- GULLY PIT



KEY PLAN

TYPICAL LAYOUT OF HIGHWAY CHECK BARRIER WITH LAYBYE ON ONE SIDE (FOR TWO LANE HIGHWAY)

PLATE – II



AREA TO BE SUITABLY LANDSCAPED TO AVOID ENCROACHMENTS

LENGTH AND NO. OF PARKING BAYS AS PER DESIGN DEMAND

NOTE

1. PROPER LANDUSE CONTROLS MUST BE ENFORCED WITHIN THE INFLUENCE AREA OF THE CHECK BARRIER
2. DIMENSIONS AS SHOWN IN THE DRAWING ARE IN METRES. AND ARE INDICATIVE OF A TYPICAL CASE AND SHOULD GENERALLY BE TREATED AS DESIRABLE MINIMUM (UNLESS OTHERWISE SPECIFIED)
3. DIFFERENT COMPONENTS OF DESIGN SUCH AS MEDIAN OPENINGS, SERVICE ROADS, TURN ROUND AREAS, AND EVEN R.O.W. OF THE ROAD WILL HAVE TO BE TREATED IN A CASE SPECIFIC MANNER
4. THE TYPE DESIGN PROVIDES FOR TWO WEIGH–BRIDGES ON THE ENTRY POINT AND ONE OF THE EXITS. IF THE DEMAND FOR WEIGH–BRIDGE IS NOT ADEQUATE THE WEIGH–BRIDGE AT ENTRY MAY BE ELIMINATED AND EXTRA PARKING LANE BEYOND THE WEIGH–BRIDGE AT EXIT POINT SHOULD BE PROVIDED.

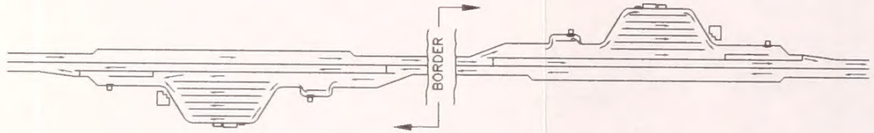
LEGEND

1. DRAINAGE SYSTEM
2. PEDESTRIAN RAILING
3. LIGHT POLES
4. HIGH MAST LIGHTING (HMT)
5. ROAD SIGNS
6. GULLY PIT

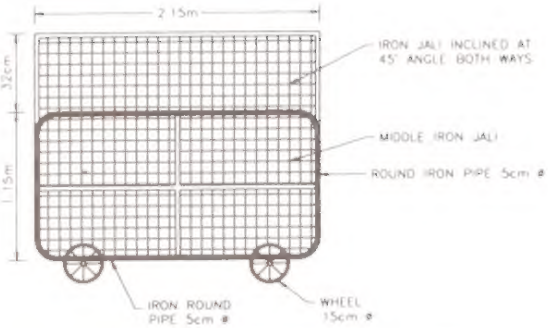
LIGHTING

STREET LIGHTING LAMINAIRE TYPE H.R.P.- 21 0
WITH 400W H.P.L. OR EQUIVALENT

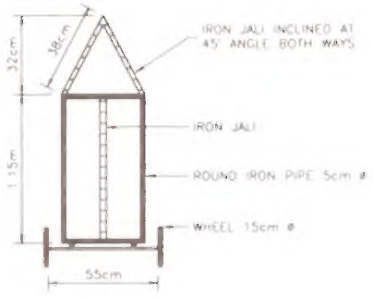
TYPICAL LAYOUT OF HIGHWAY CHECK BARRIER WITH LAYBYE ON EITHER SIDE



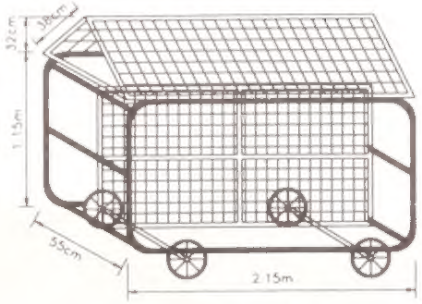
KEY PLAN



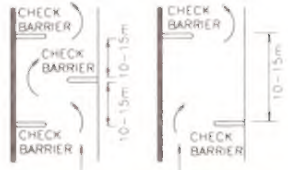
FRONT ELEVATION SCALE = 1mm : 2cm



SIDE ELEVATION



ISOMETRIC VIEW



PLACEMENTS ON ROAD

PLATE III DESIGN FOR SECURITY CHECK BARRIER